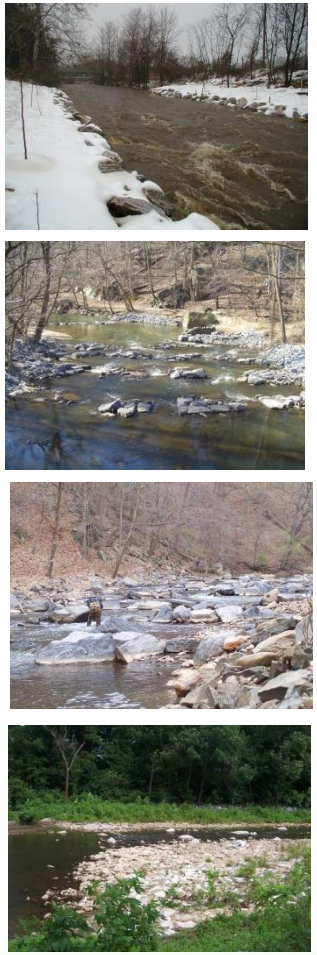
Jun 5th, 4:05 PM - 4:25 PM

Session C3 - A 10 Year Retrospective Look at the Current Condition and Success of Nature-Like Fishways Installed on Three Maryland Rivers

Kathy Hoverman
KCI Technologies, Inc



A 10 Year Retrospective Look at the Current Condition and Success of Nature Like Fishways on Three Maryland Rivers

National Conference on Engineering and Ecohydrology for Fish Passage

The State of Knowledge on Passage of River Herring

June 6, 2012

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Woodrow Wilson Fish Passage Structures

Project Setting

- Mitigation for the Woodrow Wilson Bridge Project
- Within National or Regional Park
- Urban Watershed
- 5 year monitoring requirement

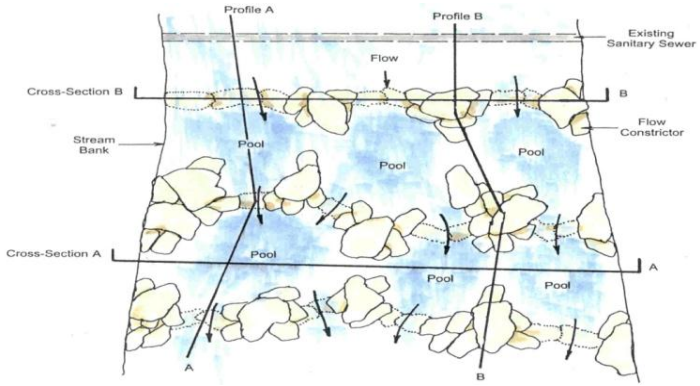
Types of Structures

- Rock Ramps/Riffle Grade Control
- Flow Constrictor Step Pools

Mitigation Sites

- Rock Creek
- Northwest Branch
- Sligo Creek
- Little Paint Branch

Design Parameters and Template



- Simulate Natural Conditions
- Multiple Flow Paths
- 0.5 ft drop/step
- Minimum 10 ft spacing

- Maximum EDF of 4
- Maximum 2.5% slope for RGC
- Resting Features

Monitoring Activities

Types of Monitoring

- Physical Structure
- Electrofishing and Ichthyoplankton Survey
- Habitat and Macroinvertebrate Survey

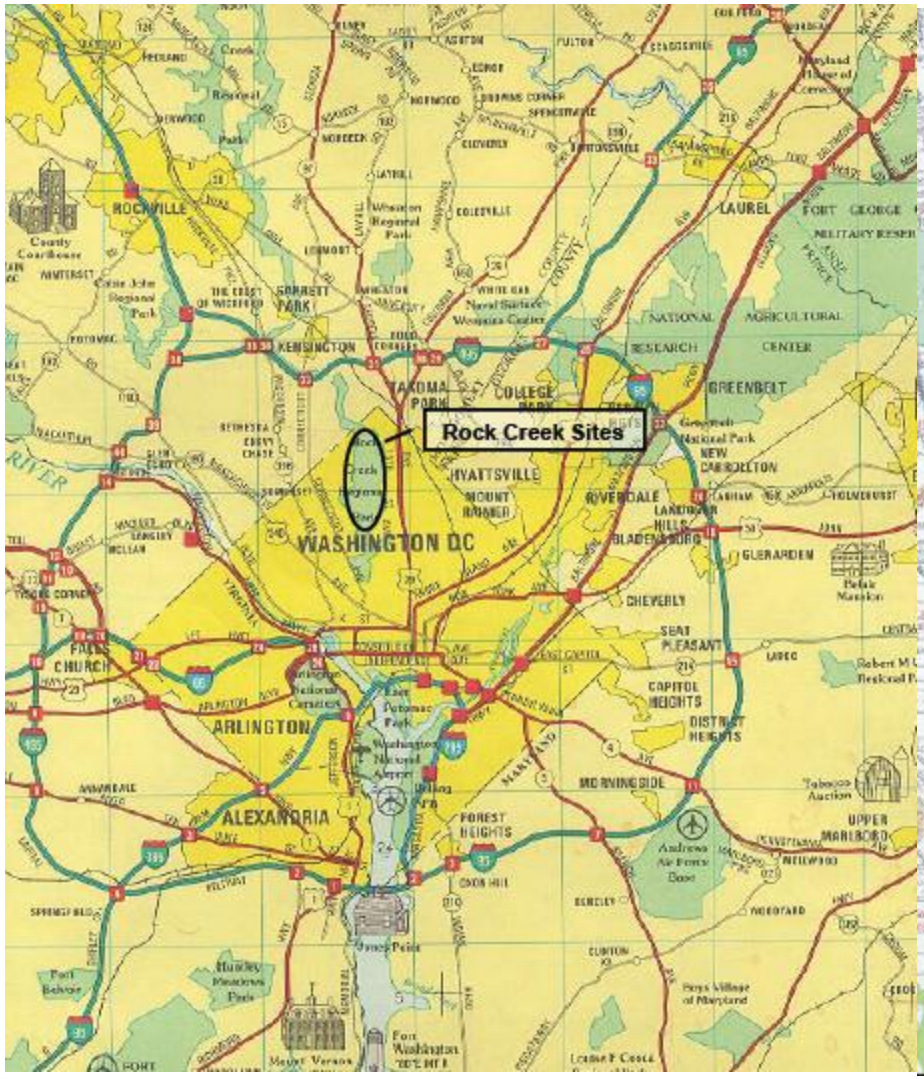
Target Species

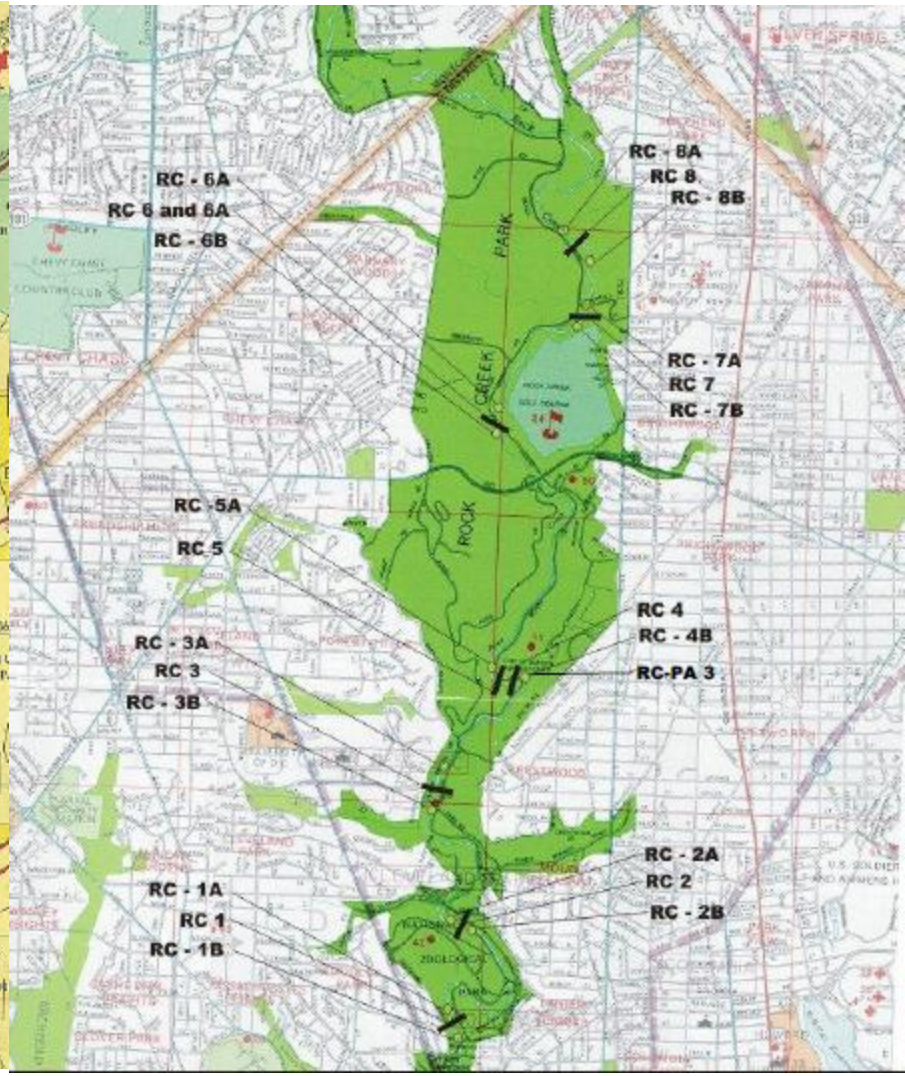
- Alewife, Blueback
- American Shad, Hickory Shad
- White Perch, Yellow Perch, Striped Bass

Assumptions

- Maintain design parameters and stable means passable
- Presences means passage

Rock Creek Fish Passage Structures





Rock Creek Design Parameters

General Passage Requirements

- **Discharge at RC-1**

Design Flow (cfs)	Normal Flow (cfs)	Operating Flow (cfs)	Drainage Area (sq mi)
30	62	205	62

- **Velocity = 3 ft/s maximum**
- **Depth = 1 ft minimum**

Structures

- **RC-1 – Blockage removal and cross vane installation**
- **RC-2 and 4 – Blockage removal and channel grading**
- **RC-3 - Denil Fishway**
- **RC-5,6,7 and 8 - FC/SP**

View of Rock Creek Flow Constrictor/Step Pool Structure RC-8

Rock Creek Monitoring Results

Percentages of Depths and Velocities that meet design Criteria

Site	Depth at Low Flow	Velocity at Low Flow	Depth at High Flow	Velocity at High Flow
2009				
RC-1	91%	100%	100%	95%
RC-2	55%	100%	100%	100%
RC-3	100%	100%	100%	100%
RC-4	100%	100%	100%	100%
RC-5	87%	87%	95%	76%
RC-6	84%	91%	100%	67%
RC-7	77%	92%	96%	76%
RC-8	68%	78%	70%	79%
2010				
RC-3	100%	100%	100%	100%
RC-5	100%	71%	100%	55%
RC-6	100%	86%	100%	70%
2011				
RC-3	100%	100%	100%	86%

Rock Creek Fish Surveys

Species	Year	Zoo	PM	Picnic 3	Military Rd	Sherrill Dr	DC line	Total #
Alewife	2000	457	19	x	x	x	x	476
Alewife	2001	202	12	x	x	x	x	214
Alewife	2002	377	-	-	-	-	x	377
Alewife	2003	464	13	-	-	-	x	477
Alewife	2004	377	-	-	-	-	x	377
Blueback	2001	1	x	x	x	x	x	1
Yellow Perch	2001	-	1	x	x	x	x	1
Yellow perch	2004	-	1	-	-	-	x	7
American Eel	2000	19	9	x	x	x	x	28
American Eel	2001	11	22	x	x	x	x	33
American Eel	2002	9	13	7	1	1	x	29
American Eel	2003	14	32	2	1	-	x	49
American Eel	2004	31	38	7	5	4	x	85

Construction at RC-1, RC-2, RC4, RC-7, RC-8 was from 2004-2005

Rock Creek Fish Surveys

Species	Year	Zoo	PM	Picnic 3	Military Rd	Sherrill Dr	DC line	Total #
Alewife	2005	-	6	-	-	-	-	6
Alewife	2006	-	1	-	-	-	-	1
Alewife	2007	-	56	-	-	-	-	56
Alewife	2010	-	14	-	-	-	-	14
Alewife	2011	-	18	-	-	-	-	18
Blueback	2010	-	4	-	-	-		4
Striped Bass	2005	-	1	-	-	1	-	2
White Perch	2005	-	1	-	-	-	-	1
White Perch	2006	-	1	-	-	-	-	42
Yellow Perch	2008	-	1	-	-	-	-	1
Yellow Perch	2011	-	1	-	-	-	-	1
American Eel	2005	38	42	2	1	1	-	84
American Eel	2006	57	102	4	4	4	5	176
American Eel	2007	51	150	3	2	4	4	214
American Eel	2008	56	44	13	9	8	2	132
American Eel	2009	37	35	14	8	9	9	112
American Eel	2010	32	15	15	13	8	3	86

Construction at RC-5 and RC-6 was in 2005
Construction at RC-3 occurred in 2006

Rock Creek Monitoring Results

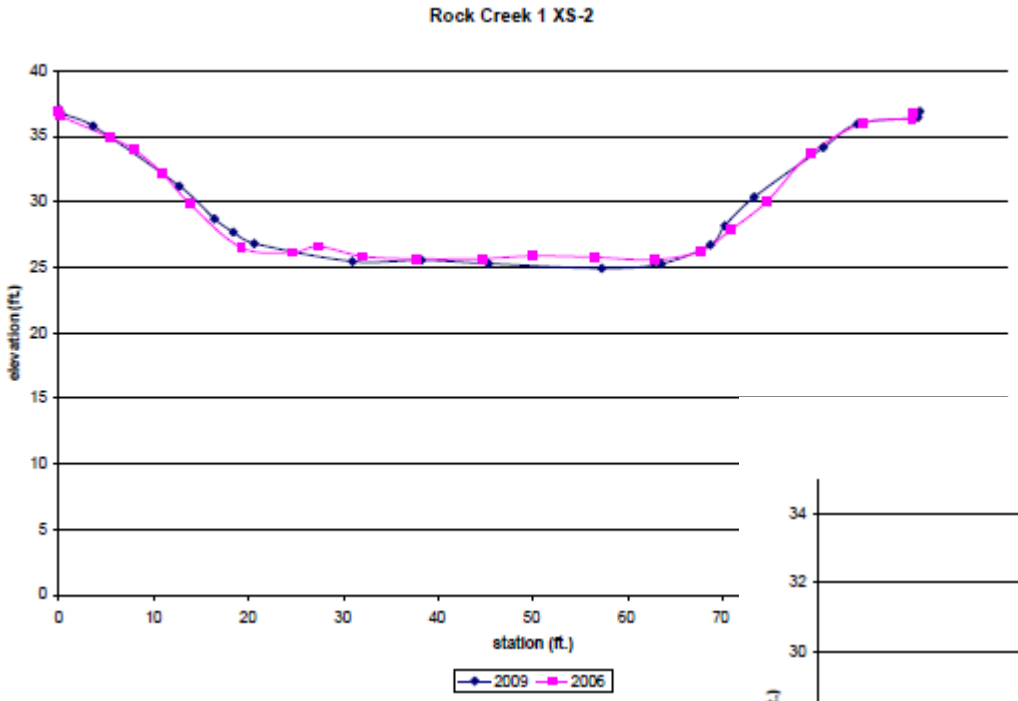
Ichthyoplankton Surveys

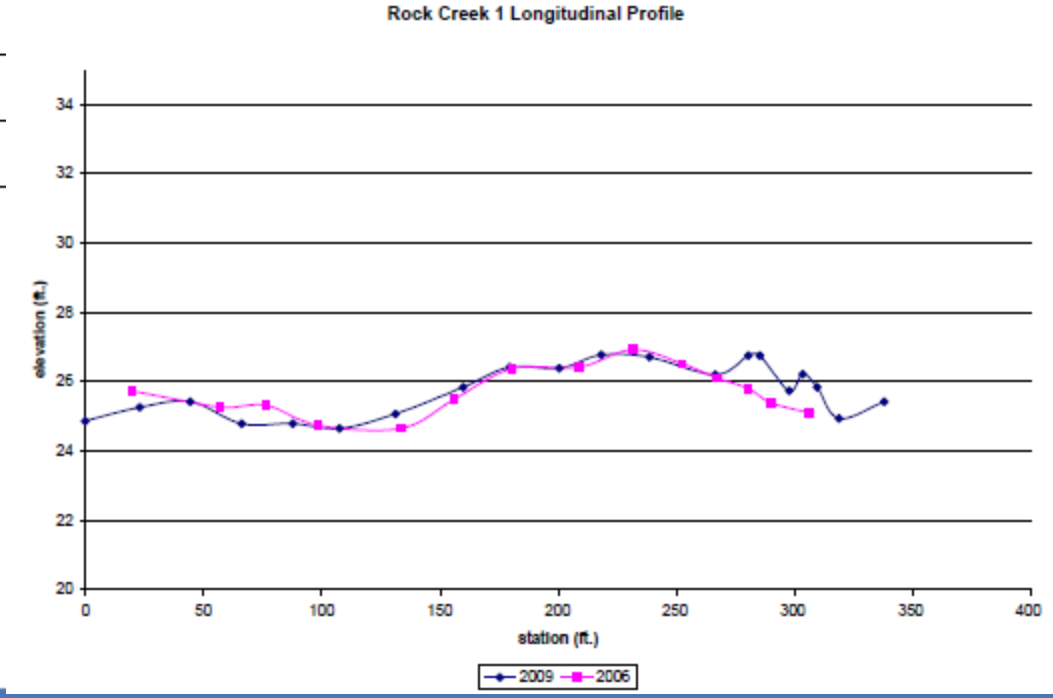
Site	Date	Species Collected	Form
Above RC-3	4/10/2009	River herring (alewife)	Egg (1)
Above RC-3	4/15/2009	River herring (alewife)	Egg (1)
Above RC-3	4/24/2009	River herring (alewife)	Egg (78)
Above RC-3	5/1/2009	River herring (alewife)	Egg (3)
Above RC-3	4/21/2011	River herring (alewife)	Egg (1)
Above RC-3	5/10/2011	River herring (blueback)	Egg (1)

No River Herring Eggs were found in 2010 or 2012 surveys

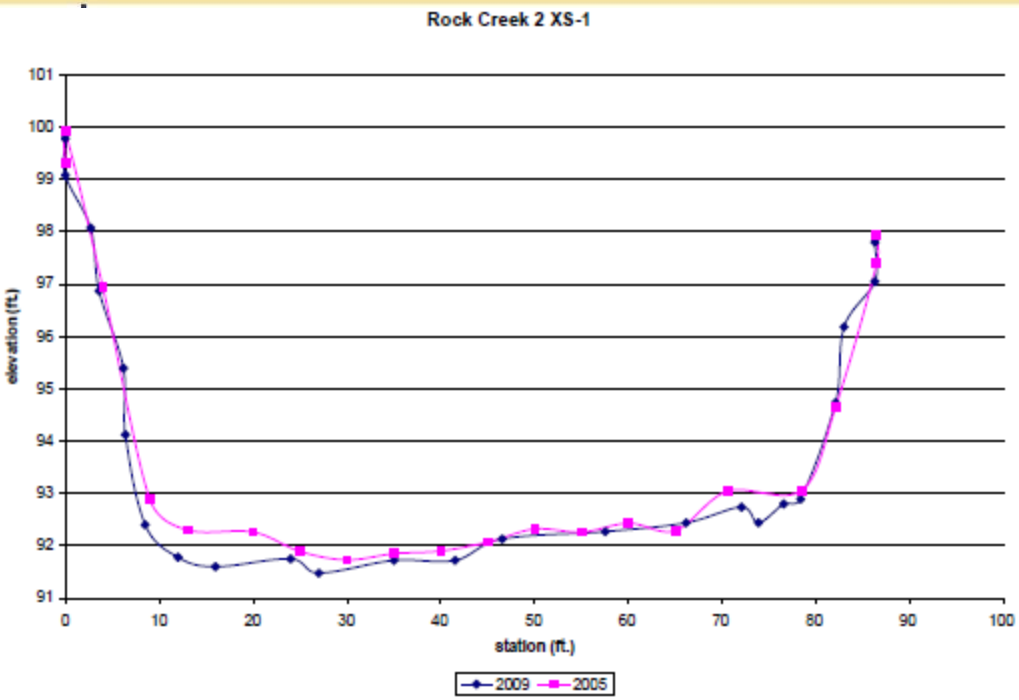
Minimal herring run was observed throughout lower reaches of Rock Creek since 2010

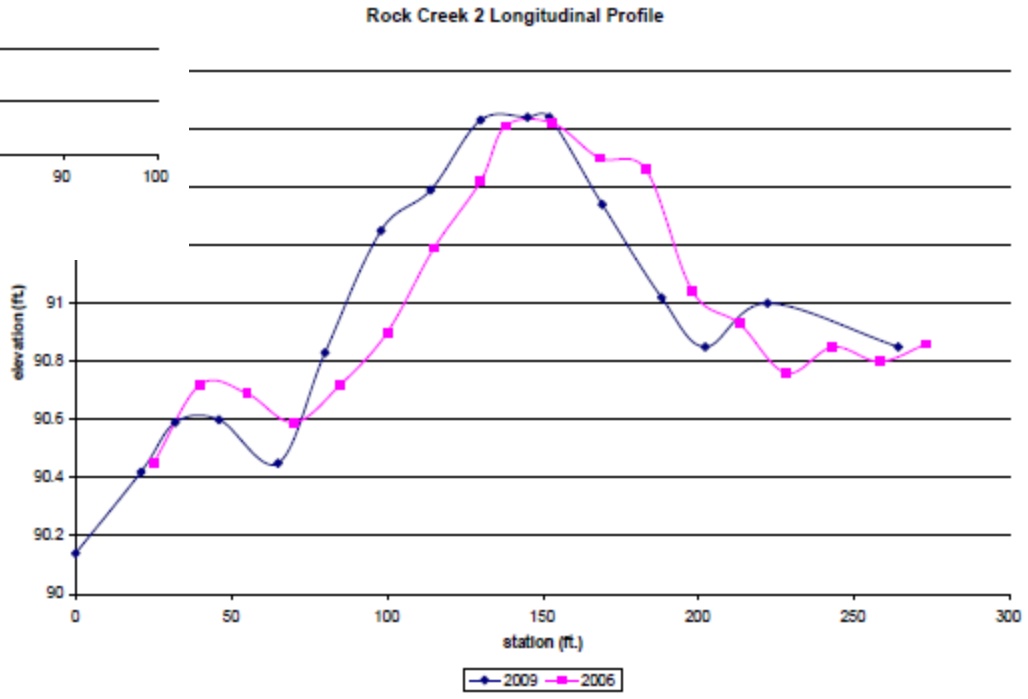
RC-1 Results


Rock Creek 1 XS-2
elevation (ft.)
station (ft.)
2009
2006

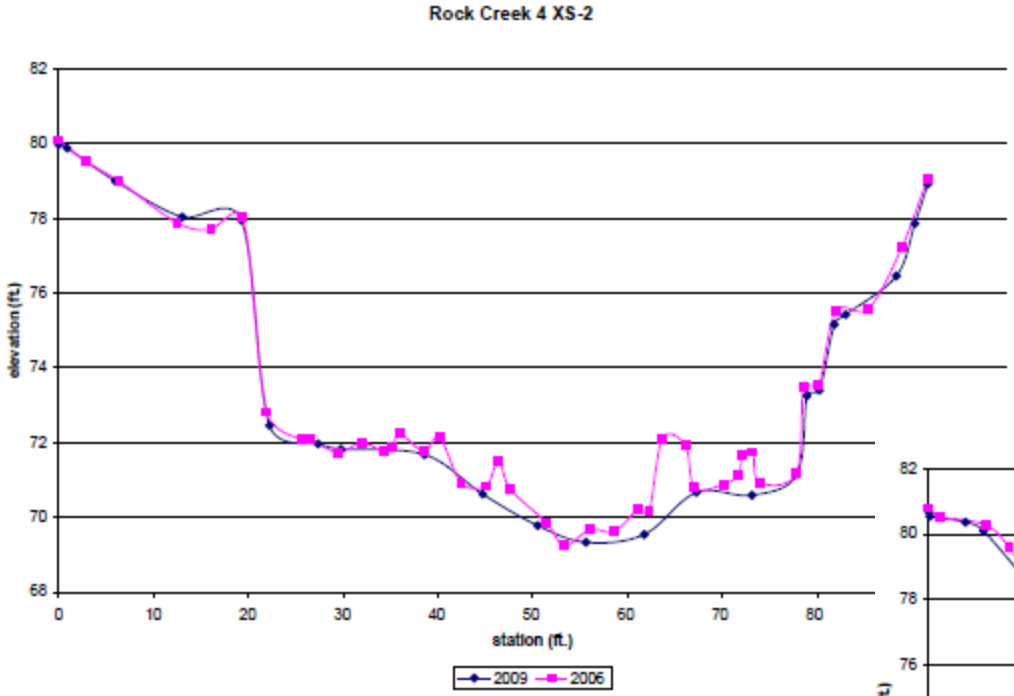

Rock Creek 1 Longitudinal Profile
elevation (ft.)
station (ft.)
2009
2006

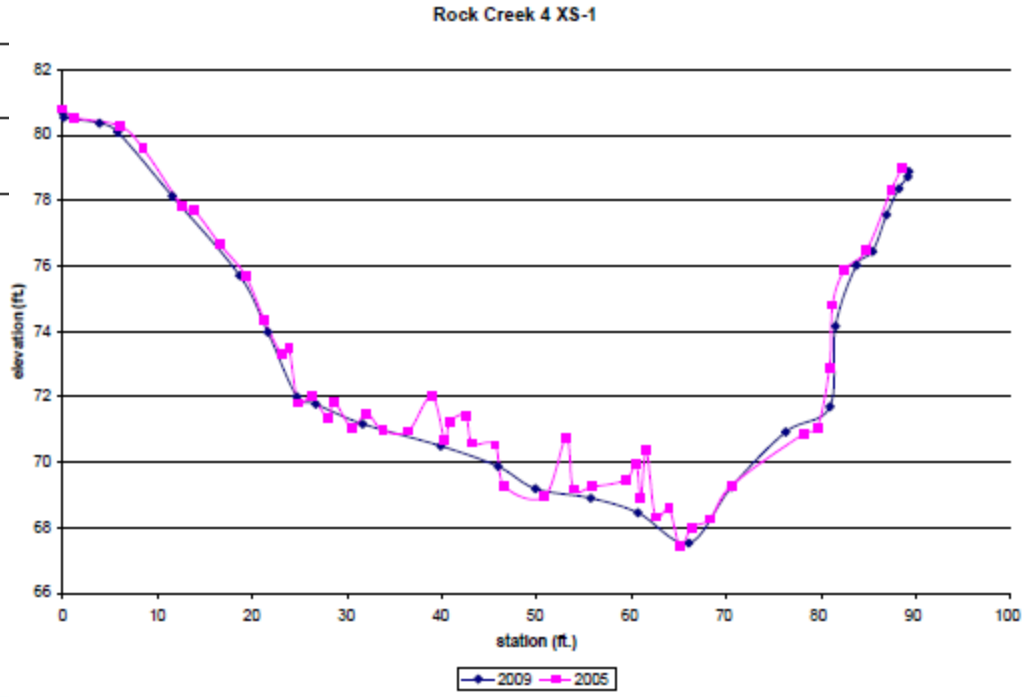
RC-2 Results


Rock Creek 2 XS-1
elevation (ft.)
station (ft.)
2009
2005

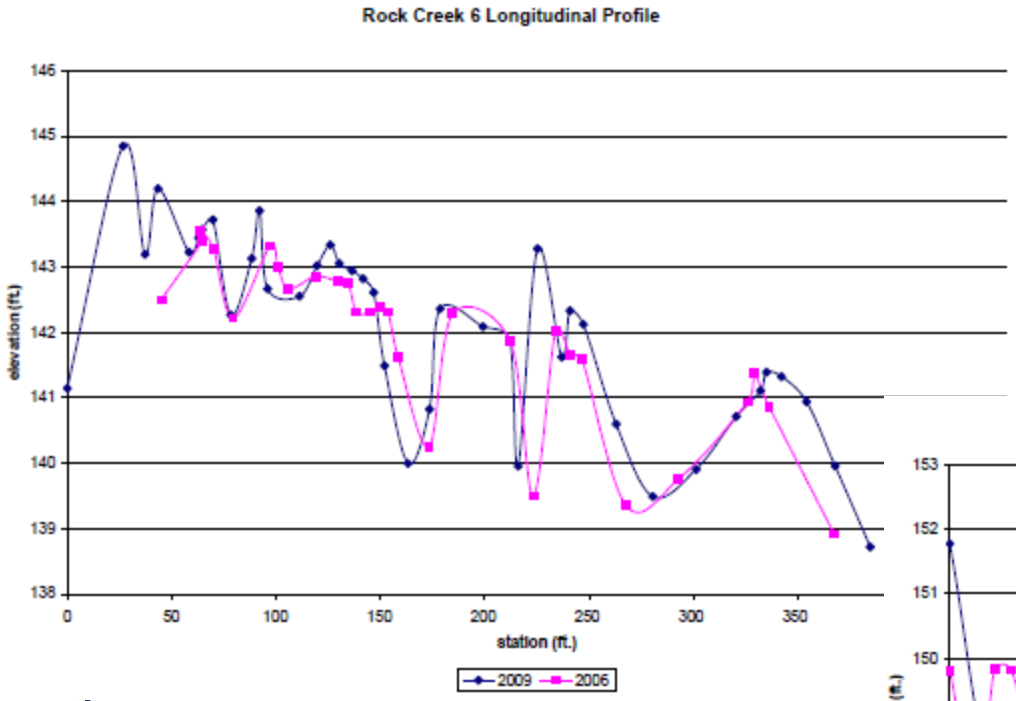

Rock Creek 2 Longitudinal Profile
elevation (ft.)
station (ft.)
2009
2006

RC-4 Results

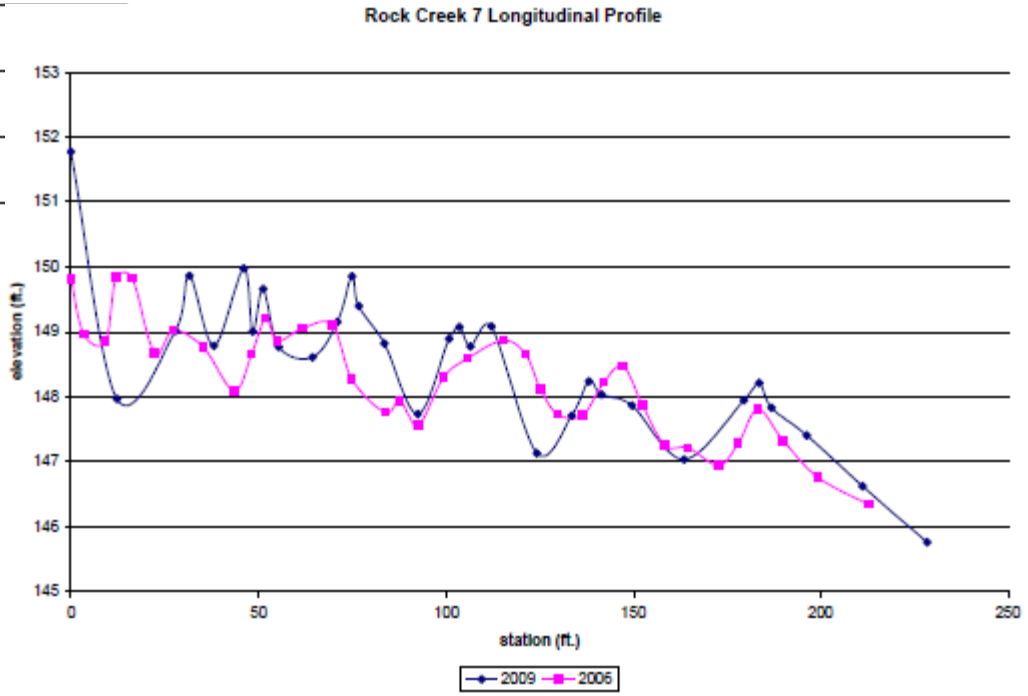

Rock Creek 4 XS-2
elevation (ft.)
82
80
78
76
74
72
70
68
0
10
20
30
40
50
60
70
80
station (ft.)
2009
2006


Rock Creek 4 XS-1
elevation (ft.)
82
80
78
76
74
72
70
68
66
0
10
20
30
40
50
60
70
80
90
100
station (ft.)
2009
2005

RC-6 and 7 Results

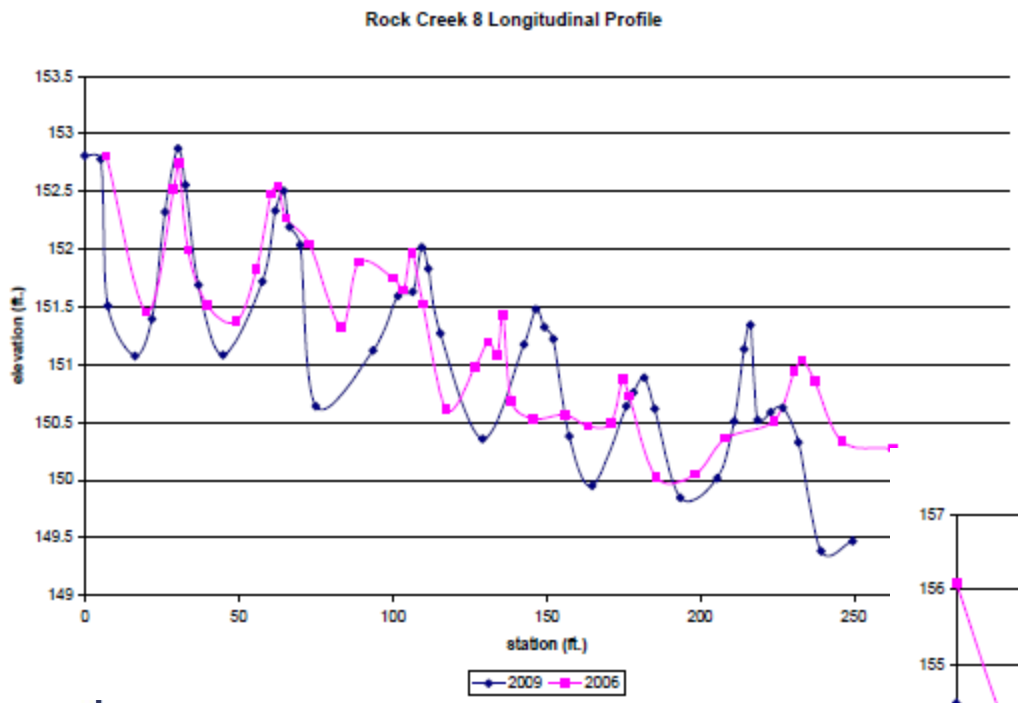


RC-6 Slope ~ 0.8%

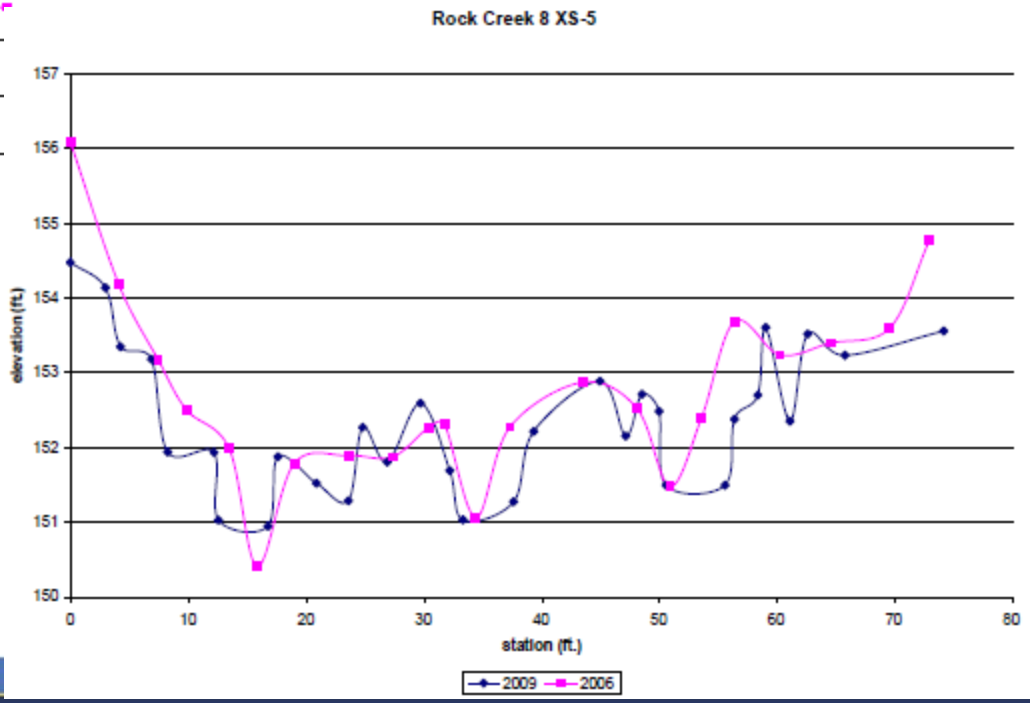


RC-7 Slope ~ 1.2%

RC-8 Results



RC-8 Slope ~ 0.8%

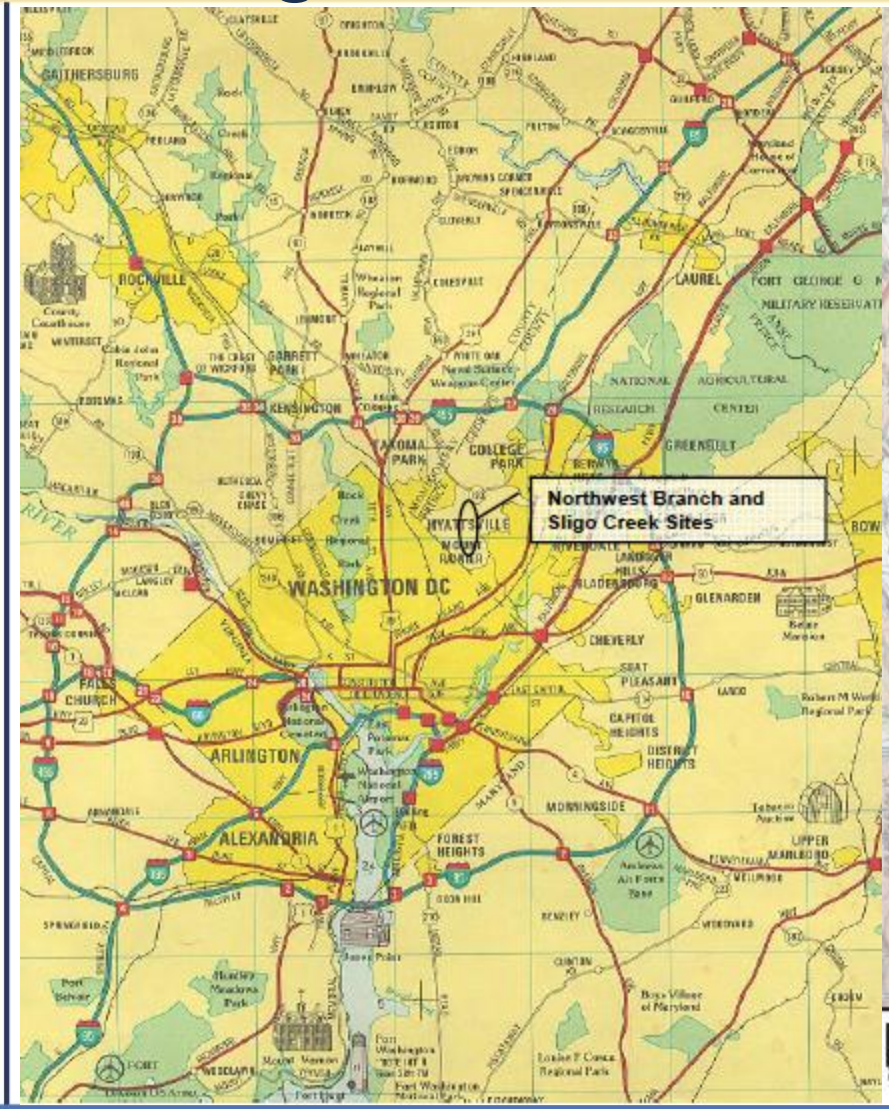


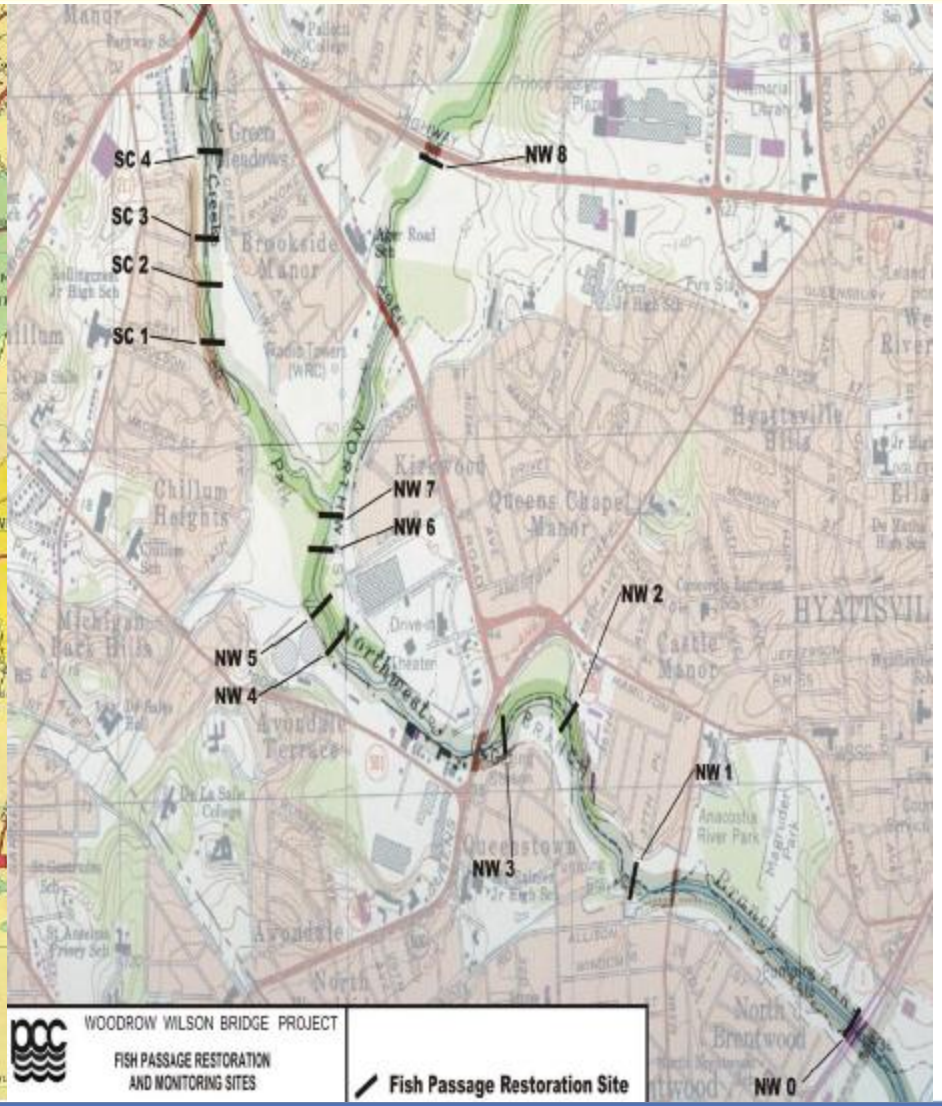
Flow Constrictor/Step Pool Stability

Flow Constrictor/Step Pools

- Occasional clogging
- Minor maintenance required
- Downstream most weir tie-in

North West Branch and Sligo Creek Fish Passage Structures





Northwest Branch and Sligo Creek Design Parameters

General Passage Requirements

- **Discharge at downstream extents**

Stream	Design Flow (cfs)	Normal Flow (cfs)	Operating Flow (cfs)	Drainage Area (sq mi)
Northwest Branch	19	40	150	48
Sligo Creek	7	14	48	11

- **Velocity = 3 ft/s maximum**
- **Depth = 0.68 ft minimum**

Structures

- **NW- 0, 1, 3, 4, 5, 6, 7 and 8 – RGC**
- **SC-1 - RGC**
- **SC- 2, 3 and 4 - FC/SP**

NW6 Riffle Grade Control Post Construction

Sligo Creek Half Channel Structures

Northwest and Sligo Monitoring Results

Percentages of Depths and Velocities that meet design Criteria

Site	Depth at Low Flow	Velocity at Low Flow	Depth at High Flow	Velocity at High Flow
2009				
SC-3	100%	100%	100%	90%
SC-4	87%	94%	97%	**59%***
NW-4	100%	100%	100%	62%
NW-5	100%	100%	100%	90%
NW-6	100%	96%	100%	74%
NW-7	100%	96%	100%	74%
* No Possible route was found to meet criteria				

NW and Sligo Fish Survey Results

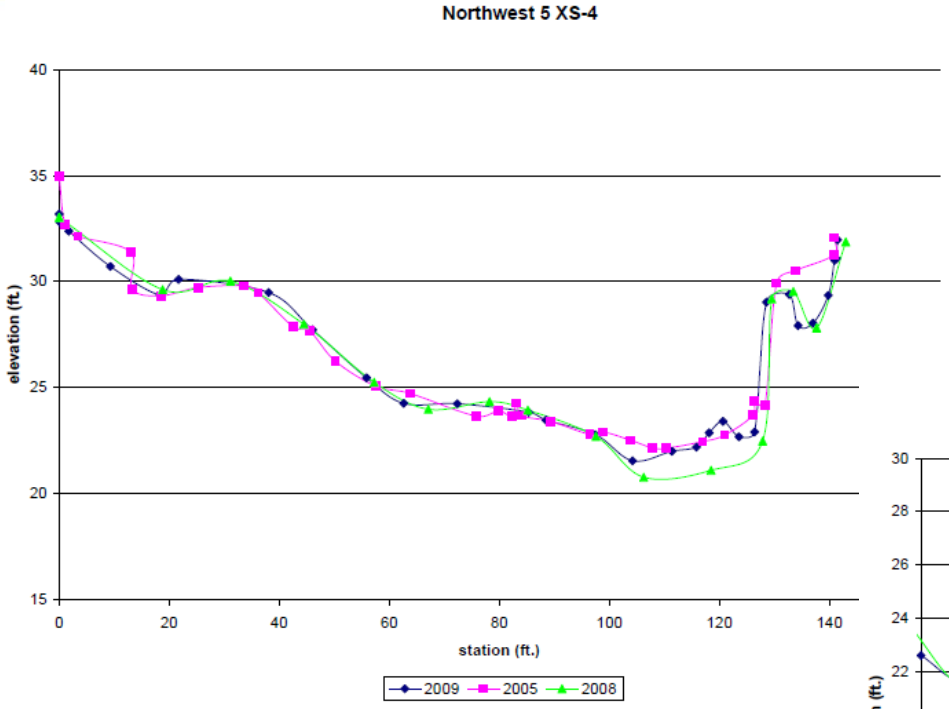
Ichthyoplankton Surveys

Site	Date	Species Collected	Form
NW-3	4/27/2009	River herring	Eggs
NW-4	4/27/2009	River herring	Eggs
NW-3	4/29/2009	River herring	Eggs
NW-3	5/13/2009	River herring	Eggs
NW-4	5/13/2009	White Perch	Eggs

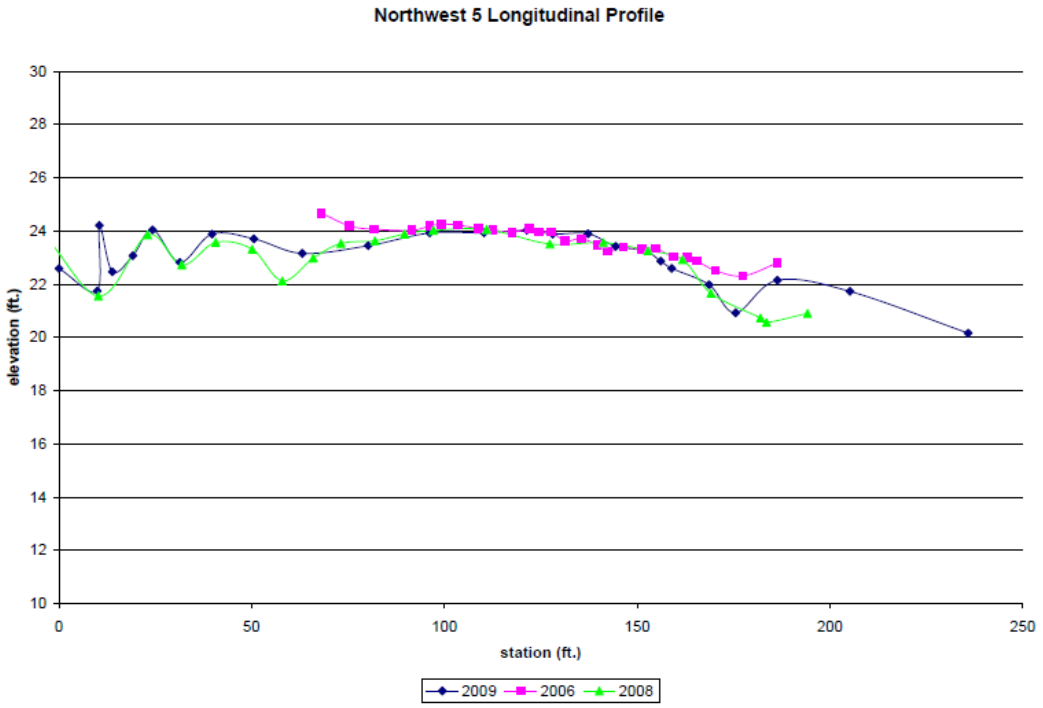
Previous samples had only found eggs up to NW-3

No sampling was done in Sligo Creek due to a lack of spawning evidence above NW-6.

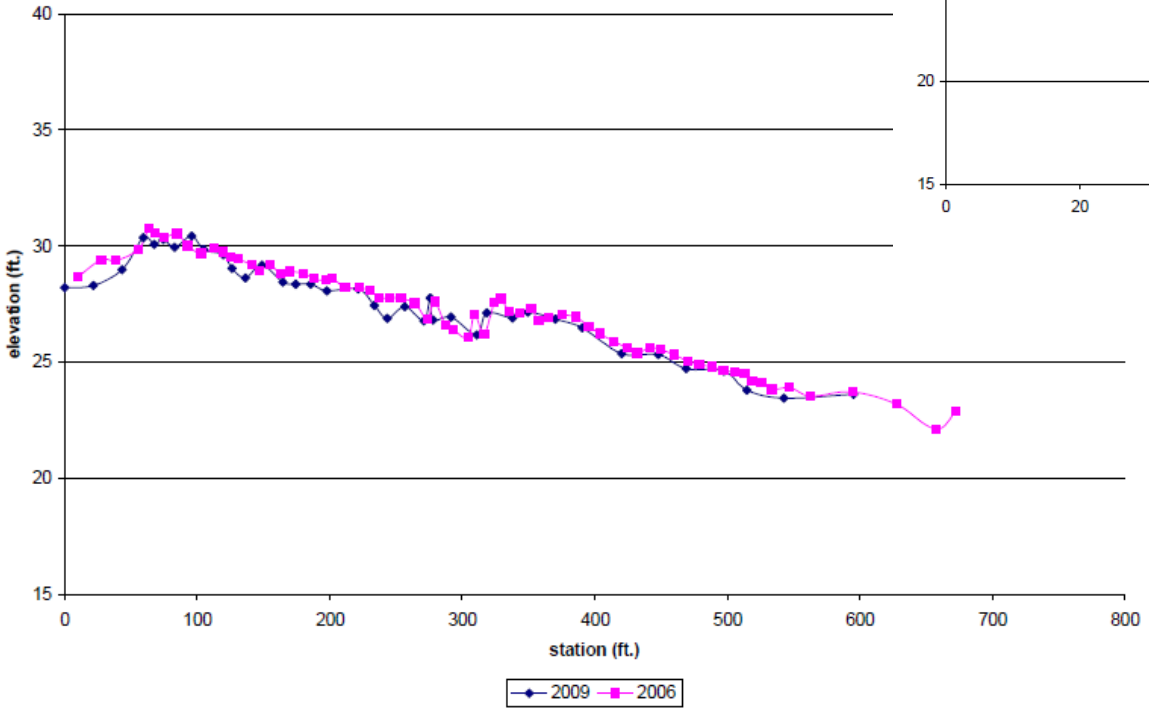
NW-5 Results

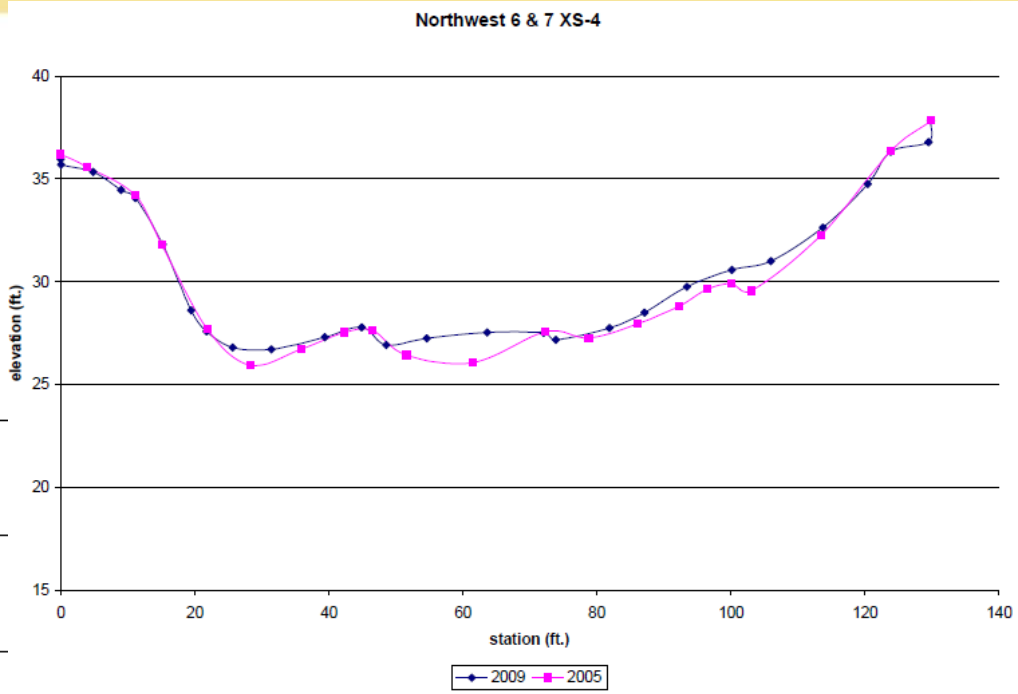


NW-5 Slope ~ 1.7%



SC-6 and 7 Results

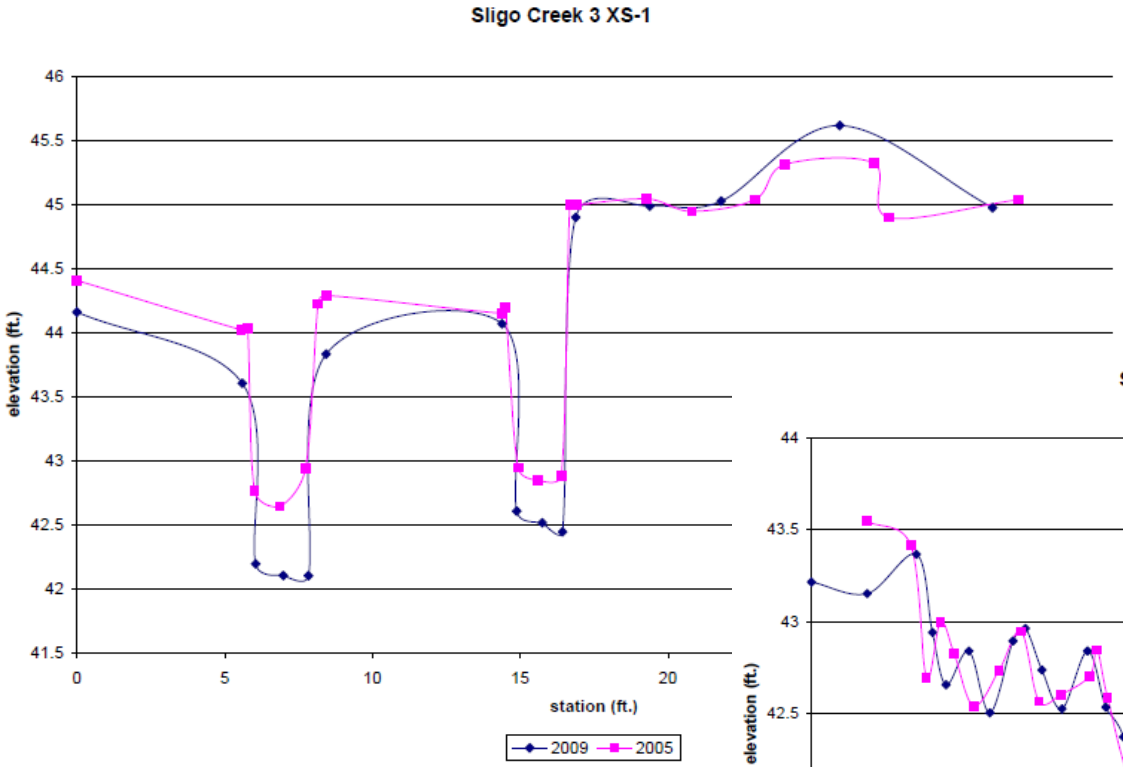


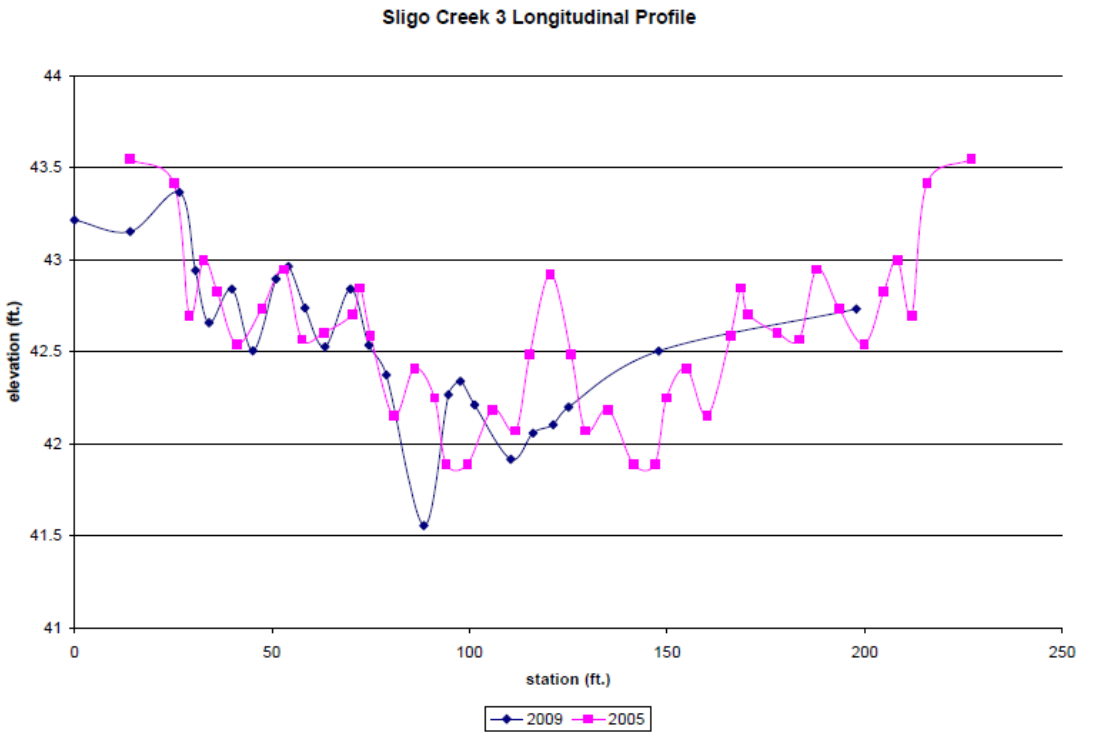


NW-6 Slope ~ 1.1%

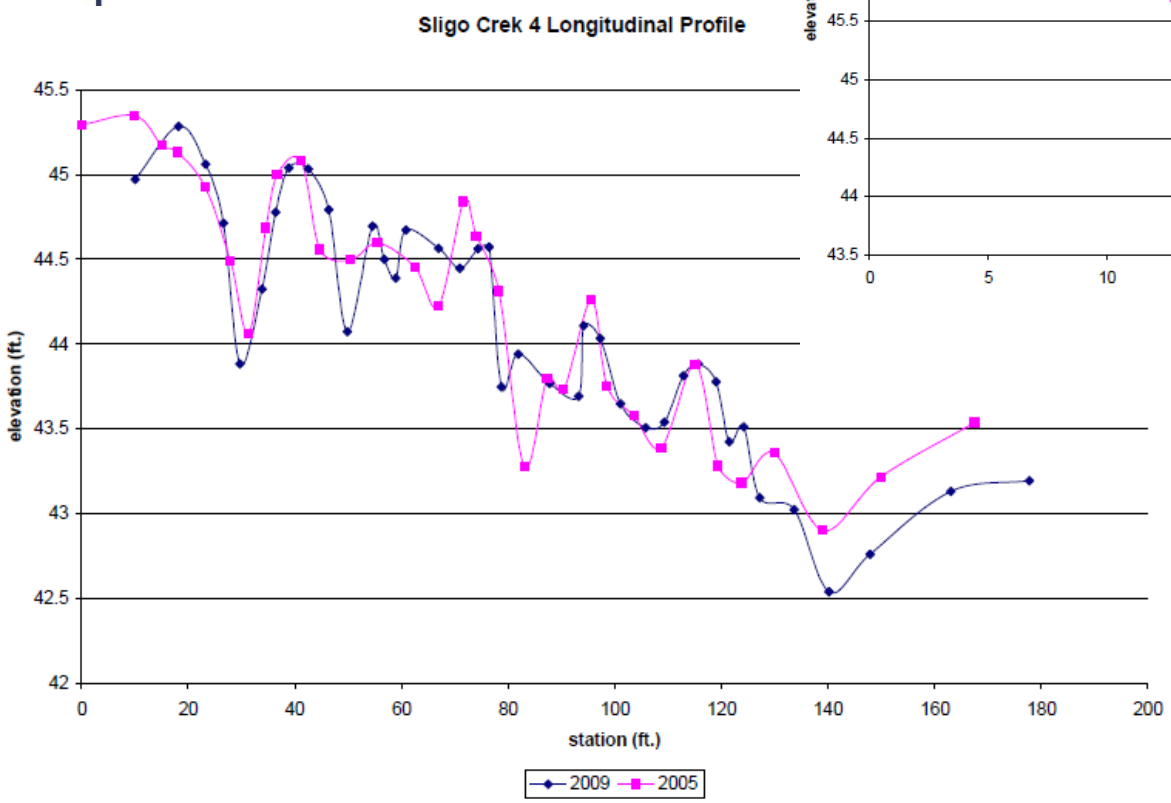
NW-7 Slope ~ 1.7%

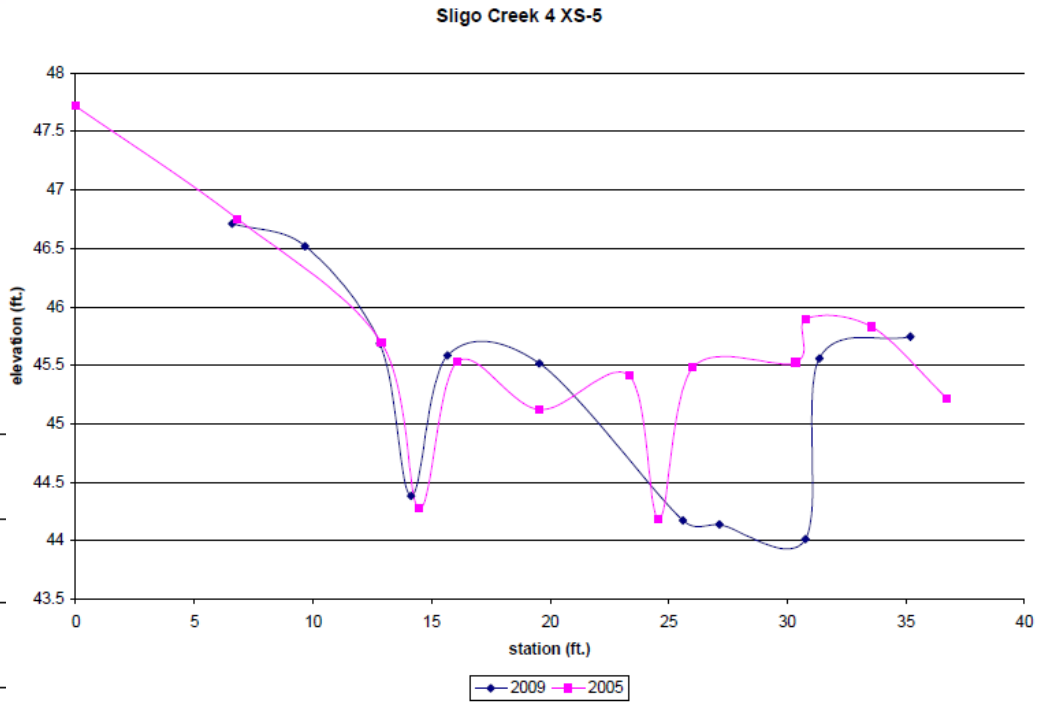
SC-3 Results


Sligo Creek 3 XS-1
elevation (ft.)
46
45.5
45
44.5
44
43.5
43
42.5
42
41.5
0
5
10
15
20
station (ft.)
2009
2005


Sligo Creek 3 Longitudinal Profile
elevation (ft.)
44
43.5
43
42.5
42
41.5
41
0
50
100
150
200
250
station (ft.)
2009
2005

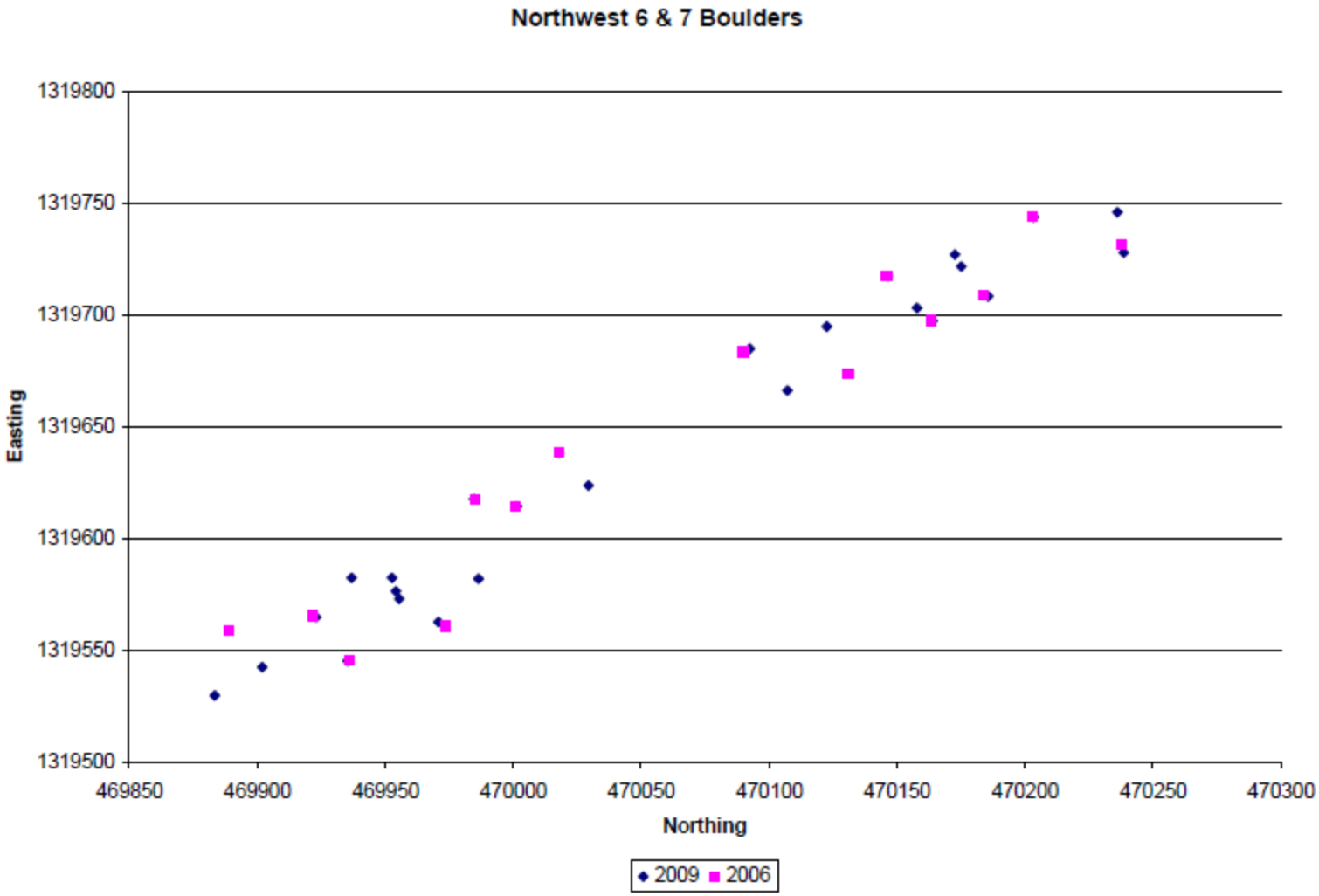
SC-4 Results





SC-4 Slope ~ 1.3%

Boulder Clusters



Summary Stability Results

RGC Summary

Structure	Slope	Stability Concerns	Fish Passage
RC-1		No	Yes
RC-2		No	Yes
RC-4	0.6%	No	Yes
NW-5	2.0%	Yes	Yes
NW-6	1.1%	No	Yes
NW-7	1.7%	No	Yes
NW-8		No	Yes

FC/SP Summary

Structure	Slope	Stability Concerns	Fish Passage
RC-5	1.1%	No	Yes
RC-6	0.8%	Shifting but Stable	Yes
RC-7	1.2%	No	Yes
RC-8	0.8%	No	Yes
SC-2		No	Yes
SC-3		No	Yes
SC-4	1.3%	Yes – side loss	Yes

Post Monitoring Considerations

- Not maintenance Free
- Flat Rocks with base support
- Multidirectional stone placement
- Use of multiple flow paths for multiple flows
- Pre con data is very helpful!

Next Time…

More Data for More Knowledge

- Assess for new blockages
- Adaptive monitoring program

Thanks and Appreciation

Todd Nichols
Project Funding/Sponsor

Patrick DiNicola
Data Collection and
Monitoring Assessments

Eric Thadey
Fish Collection Data